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Performance Based Logistics: A Path to Reduced Reliance on Contractor Technical Support for Weapon Systems in the Field?

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ABSTRACT

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This paper examines the effect that Performance Based Logistics (PBL) arrangements will have on the number of contractors required to deploy for technical support of weapon systems. The paper reviews the historical use of contractors on the battlefield and analyzes recent trends in deployed contractor support, focusing specifically on contractors providing technical support for weapon systems. The paper reviews the policies of the Department of Defense (DoD) and the US Army on Performance Based Logistics (PBL)—the DoD preferred approach for acquiring support for weapon systems. It examines several current PBL arrangements for their impact on the number and type of contractors to be deployed with combat forces. Finally, the paper speculates on long-term implications as PBL arrangements proliferate and makes recommendations for future PBL implementation.

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Introduction

Many recent writings describe the military's over reliance on contractors and the resulting complications that commanders face. It is true that contractors on the battlefield can complicate the commander's combat mission by adding to his logistical footprint, his requirements for care and feeding, and his requirements to provide physical and personnel security. Contractors on the battlefield can also present ethical issues if and when contractors are killed in combat. Ideally, military forces should deploy totally self-sufficient and should not require augmentation from a team of contractors. But seldom is reality aligned with the ideal, and contractors have always been deployed with forces and likely will always be an integral and essential part of the deployed force. The trick is to minimize their numbers. The question is how to do it without compromising the commander's ability to accomplish his mission.

Performance Based Logistics (PBL) is the Department of Defense's (DoD) preferred approach for acquiring support for weapon systems, but it remains unknown whether PBL strategies will effectively reduce the number of contractors on the battlefield. The paper reviews the historical use of contractors on the battlefield and examines recent trends in deployed contractor support, focusing specifically on contractors providing technical support for weapon systems. This paper then analyzes the effect that PBL arrangements will have on the number of contractors required to deploy for technical support of weapon systems.

Contractors on the Battlefield

History

From the founding of our nation, each and every time that American forces have seen combat, contractors have accompanied our troops on the battlefield [1]. Contractors have consistently provided valuable assistance to our military forces by performing services such as transportation of supplies, feeding soldiers, building and caring for housing, and providing technical support for complex weapon systems. Although it is difficult to quantify the total number of contractors supporting our forces, it is now clear that the DoD relies on a growing number of contractors to keep our combat forces in action.

One of the key factors contributing to more contractors on the battlefield has been DoD's growing reliance on contractors to provide initial or lifetime support for high-tech weapon

systems. "Systems contractors provide support to weapons systems and other systems usually under contracts with the relevant system program manager. Mission-enhancing and mission-essential maintenance and operations services are typically provided. These contracts often involve sophisticated technical expertise unavailable or of limited availability within the uniformed military" [2]. Commanders consistently emphasize the value that contractors bring to our forces and many commanders state that they would not have been successful if they had deployed without their habitually associated contractor teams. Due to the valuable services that contractors provide in the way of forward maintenance and technical assistance, many commanders today would not leave home without their full complement of contractors. As the technology of military forces has increased, so has the number of contractors accompanying the force. Contractors have been with our deployed forces forever and they are there for many reasons. It is now time to understand just how dependent the DoD has become and to seek ways to mitigate the risks—a sentiment echoed in a recent article of *Army Logistician*.

> The combined effects of defense budget cuts, force reductions, reengineering initiatives, the privatization of duties historically performed by military personnel, the introduction of increasingly complex technology, and increased mission requirements and operational tempo have shifted the [contractor-government] mix of support needed to carry out mission objectives in a theater of operations. The supported combatant commanders and the services are beginning to recognize the extent of their reliance on non-uniformed support. [3]

Issues

Although the high-tech nature of our weapon systems necessitates more and more contractor support, it is growing even more necessary to properly integrate contractors into our forces and to seek to minimize the contractors' footprint in the battle space. It is without question that contractors provide a much needed, highly valuable service to our forces. But recent discussion centers on the complications that commanders face as a result of this extensive use of contractors. Many are now suggesting that we must reduce our reliance on contractors and reduce the number of contractors deployed with our forces.

Contractors deployed with our military forces create many concerns for the military commander because the contractors do not have the same status as a military soldier. Concerns for the commander include the contractor's status as a combatant/non-combatant; care and feeding; command and control; welfare and discipline; contractor security and force protection;

industry concerns about liability, safety, security, and cost during contingencies; very high visibility; accountability issues; etc.

In addition, contractors are not part of the formal military chain of command and they can technically choose to leave the combat zone at any time, leaving the military commander without a critical support capability. Although unlikely and very rare (the author has been unable to find a single case of a contractor deciding to leave the combat zone and not perform under the terms of the contract) these are decisions that the contractor can make, adding uncertainty to military operations.

Path Ahead

Deployed contractors have proven very reliable during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). In fact, contractors are often a combat multiplier, performing work that military forces cannot perform either due to lack of resources or lack of expertise. It is clear that the DoD will continue to use contractors, but issues remain with the growing use of contractors on the battlefield. The goal is to minimize the overall logistics footprint required to sustain our weapon systems, and to minimize necessity for contractors to accompany the force. But how will DoD accomplish this?

The ideal weapon system is one that does not fail for a very long time—it meets rigorous reliability requirements. When it does finally fail, it is easy to troubleshoot and easy to repair. "Easy to repair" means it is something that can be repaired by a trained solder and does not require repair by a specialized contractor technician. The ideal weapon system will not require deployed contractor support nor a large footprint of repair parts. When repair parts are required, the ideal supply chain will respond quickly to meet the demand. The ideal supply chain will accurately match the supply of parts to the demand of repairs. All elements of the ideal process will be fully integrated to maximize operational availability of the warfighting systems in the field. The Army's stated intent is to develop and field systems that do not require routine deployment of contractors and to improve system reliability and ease of maintenance [4]. PBL is a strategy that is intended to meet this intent.

Supply Chain Management (SCM)

Army Regulations define the supply chain as, "the material and informational interchanges in the logistics process stretching from the acquisition of raw materials to the

delivery of finished products to the end user. Vendors, service providers, and customers are links in the supply chain" [5]. The same regulation defines SCM as, "the management of all internal and external logistics processes, information, and functions necessary to satisfy a customer's requirement. The management of the interdependent logistics processes of customer response, inventory planning and management, warehouse management, transportation, supply, maintenance, and reverse logistics" [6]. Figure 1 and Figure 2, from the Defense Acquisition University SCM module [7], illustrate the DoD supply chain and describe SCM as the "process of implementing and controlling the efficient, cost efficient flow and storage of raw material, inventory, finished goods and related information from point of origin to consumption" [8].

Figure 1: DoD Logistics Chain.

Figure 2: Supply Chain Management.

Four key drivers affect supply chain performance and management decisions—facilities, transportation, inventory and information [9]. Facilities include factories where items are manufactured and repaired as well as locations where inventories are stored. For DoD supply chains, depot and field repair facilities are very important elements in the supply chain. Inventory includes raw materials, work in process (WIP), and finished goods throughout the supply chain. Inventories must exist to meet needs as they arise—a reflection of demand uncertainty and a highlight of the ever-present mismatch between supply and demand. The location and quantity of inventory in the supply chain can dramatically impact the cost and responsiveness of the chain. Transportation describes all activities required to move items from one location to another and includes the routes, nodes, and vehicles. Information includes the data and analysis regarding inventory, transportation, and facilities throughout the supply chain and is frequently considered the biggest driver of overall supply chain performance [10]. It is precisely because of this that improving information to reduce uncertainty is one of the key activities that PBL providers pursue relentlessly.

The DoD supply system includes wholesale and retail supply processes. The wholesale portion of the system encompasses the procurement of items from the manufacturers and suppliers. Wholesale items are generally stored in distribution warehouses and government Inventory Control Points (ICPs) until requisitioned from the retail supply system. The retail portion of the system is generally located with operational elements and is usually manned by organic DoD (to include military) personnel [11].

An element of the retail supply chain that is critical to warfighter success and satisfaction can be described as "the last mile." The "last mile" refers to the segment of the supply chain that extends from the last distribution point to the actual soldier needing the materiel. This last mile extends in both directions—from the distribution point to the soldier and from the soldier to the distribution point. Key elements in this segment include the steps to identify the need for an item, the steps to requisition a replacement item, the steps to transport it to the soldier, and the steps to return an unserviceable component to the distribution point. In the Army supply chain, separate elements perform each of these steps. The maintainer initially identifies the need for the item by troubleshooting and isolating a failed component. The supply clerk submits a requisition, receives the item and issues it to the maintainer. DoD transportation and distribution assets physically move the item to the forward supply point and return the unserviceable item for

repair. Each step contains uncertainty and increases the ultimate risk that the maintainer will not receive the item he requires.

Performance Based Logistics (PBL)

PBL Overview

PBL is a holistic approach to acquiring support for weapon systems during both peacetime and wartime. PBL focuses on total life-cycle support of a system. PBL forces Program Managers (PMs) and system developers to address logistics issues during the design phase for new systems rather than after the system enters production, or worse, after the system is fielded. PBL also provides a means for continuous system modernization. PBL arrangements offer incentives to correct deficiencies as the system matures and deficiencies emerge. PBL is an approach that contracts for performance rather than contracting for individual products, items, or services.

PBL arrangements provide clear lines of accountability for results and contain a clear set of customer-driven expectations. These customer expectations are documented in a Performance Based Agreement (PBA) between the warfaghter and the PM. The PM manages the PBL agreement via a PBA with a Product Support Integrator (PSI) and Product Support Providers (PSP). PSIs and PSPs can be either Government organic organizations or contractors. Their performance is evaluated against negotiated metrics that support warfighter requirements. PBL arrangements cover a broad spectrum, varying in degrees of complexity and risk. For example, low complexity and low risk PBLs may focus on supply chain management for wholesale level activities. Highly complex and high risk PBLs can be for total system support where the PSI and PSPs provide 100% of the sustainment and support for the system. Figure 3 illustrates this spectrum of support. PBL arrangements will vary across this spectrum depending on age of the system/subsystem (phase of the lifecycle), amount of existing infrastructure, organic capabilities versus capabilities of contractor, as well as legal and regulatory constraints.

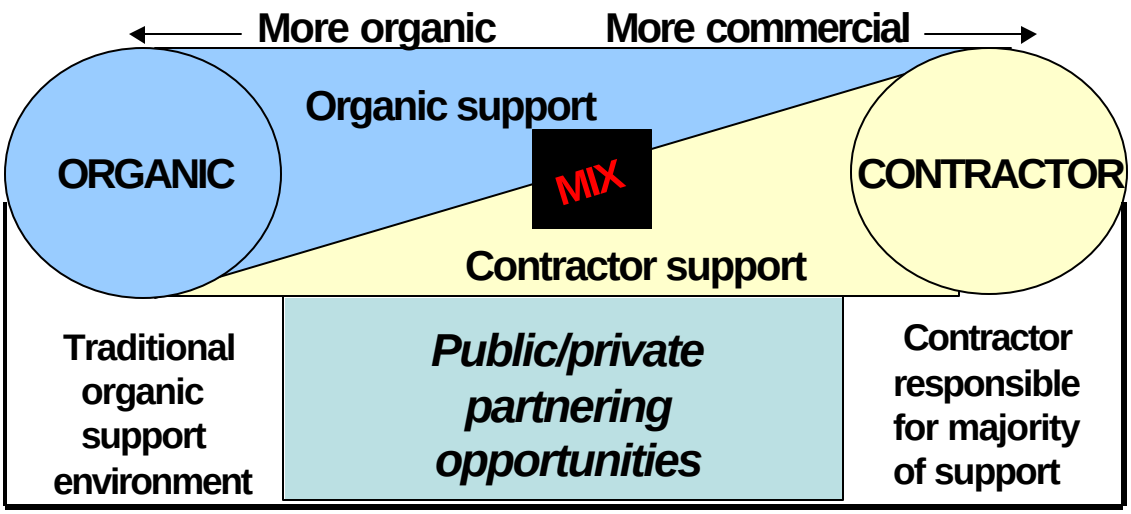

Figure 3: Spectrum of Support [12].

PBL is the DoD's preferred approach in acquiring support for weapon systems. PBL seeks to buy support as an integrated, affordable performance package to optimize system readiness. A successful PBL implementation will reduce supply chain variability, improve system availability, improve contractor profitability, and ensure warfighting capability. PBL is a relatively new concept in operational support. PBL strategies are designed to increase military readiness through implementation of performance-based agreements that buy results not resources. PBL agreements specify "what" is required and not "how" it is to be provided. PBL strategies are intended to maximize both organic and contractor support capabilities. PBL agreements can be contracts with commercial support providers or Memoranda of Agreement (MOA) with organic providers, or combinations required to deliver the total support package. Performance based contracts create an increased incentive for contractors to meet readiness objectives by tying their compensation to the operational availability of their products.

PBL arrangements are best implemented through long-term agreements with the support provider. This often means contracts worth several years of business if the provider earns it by meeting the customer's performance requirements. The acquisition PM is responsible for establishing clear lines of authority and accountability and for managing these support arrangements.

PBL Policy

PBL is the "purchase of support as an integrated, affordable, performance package designed to optimize system readiness and meet performance goals for a weapons system

through long-term support arrangements with clear lines of authority and responsibility. Simply put, performance based strategies buy outcomes, not products or services" [13]. The DoD Directive 5000.1 titled, "The Defense Acquisition System" states "…The PM shall develop and implement performance-based logistics strategies that optimize total system availability while minimizing cost and logistics footprint. Sustainment strategies shall include the best use of public and private sector capabilities through government/industry partnering initiatives, in accordance with statutory requirements" [14]. Each PBL program will seek to improve weapon system readiness by acquiring a desired level of operational performance while capitalizing on integrated logistics chains and public/private partnerships [15].

Product Support Boundaries: In a 2004 document, DoD established policy and standards to ensure that evolving PBL support strategies remain compatible with the overall DoD support structure. This document, entitled "Product Support Boundaries," is intended to "describe the boundary conditions for product support strategies that allow innovation but ensure consistency and interoperability across programs" [16,17]. PMs are required to implement all PBL arrangements in accordance with this boundary document.

The Under Secretary of Defense (Acquisition, Technology and Logistics (USD(AT&L)) has defined five top-level metric objectives for PBL arrangements. PMs will develop program specific metrics that will support these overarching DoD metric areas:

1. Operational Availability (OA): a measure of overall system readiness.

2. Operational Reliability (OR): a measure of a system meeting defined mission success objectives.

3. Cost per Unit Usage: i.e. cost per flight hour, driving mile, steaming hour, etc.

4. Logistics Footprint: a measure of the total logistics support required to deploy, sustain, and move a system. Support elements include inventory, personnel, equipment, transportation assets, facilities, real estate.

5. Logistics Response Time. A measure of the time from identification of the need to its satisfaction [18].

Why PBL?

During the last several years, the Services and DoD have taken many steps to improve the effectiveness and efficiency of the way we sustain our military forces—among these steps is

PBL. PBL has emerged as the preferred method of buying support for weapon systems and is recognized as a valuable strategy to reduce total ownership costs, improve readiness and sharpen the supply chain.

Many factors drive the move to PBL. Among these factors are the continual rise in the costs of maintenance, operations and support for our complex weapon systems. Weapon systems are more expensive now than at any time in history, and the cost of maintaining and repairing them is increasing. PBL arrangements are also valuable tools to support DoD and Army Transformation initiatives. Warfighters often express dissatisfaction with the level of support provided by the current logistics system, complaining about things like long customer wait times, poor reliability of components, and difficult troubleshooting. This warfighter discontent creates another opportunity for improvement and emphasizes the need for PBL. PBL also offers an integrated approach to modernize systems and address obsolescence issues as the systems are supported through PBL arrangements. In addition, PBL arrangements have produced documented savings in commercial support operations and in certain government programs, a factor that reinforces the need for PBL and helps explain DoD's pursuit of PBL [19]. Bottom line: the goal of any PBL arrangement is to reduce demand for logistics.

PBL Compared to Traditional Support Arrangements

PBL arrangements differ from traditional support arrangements in the way requirements are defined and support is delivered. PBL arrangements are also different in the way risks of performance are allocated and in how incentives are provided. The following paragraphs expand on each of these differences.

Defining Requirements and Delivering Support

PBL differs from traditional support arrangements in the way that support requirements are defined and in how the support providers deliver. In traditional support arrangements, the Government defines specifically how the support provider is to perform the work. In traditional arrangements, the Government buys the systems, provisions the spares, buys technical support manpower, establishes and manages the repair facilities and is responsible for all aspects of the supply chain. In short, the Government buys "resources" with a focus on keeping enough spares available throughout the supply system to meet customer demands. The Government typically accomplishes this by purchasing a relatively large number of spares and setting up a robust repair

capability in either a Government depot or a contractor's facility. The Government addresses uncertainties in demand (driven by changing Operational Tempo (OPTEMPO), surges, or unanticipated failures, etc.) by purchasing more spares and the capability to do more repairs. The Government buys parts to address failures and intensively manages supplies. The traditional support system has resulted in what we see today: a large outdated infrastructure, aging fleets, failing reliability, increasing obsolescence, and rising ownership costs.

PBL is a significant change in the way DoD supports weapon systems. PBL changes the current practice of buying parts and managing inventories to buying performance and managing outcomes. PBL attacks logistics failures by improving reliability, resolving obsolescence and integrating system support solutions. "The cornerstone of PBL is the acquisition of weapon systems and equipment sustainment as an affordable, integrated package based on attaining output measures such as weapons system availability, rather than focusing on separate input measures, such as parts, training, maintenance and technical services" [20]. PBL performance metrics focus on operational availability, operational reliability, cost-per-unit usage, reduced logistics footprint and reduced response time of the supply system. This is a major shift from the traditional approach to product support. While the traditional approach buys "resources," the PBL approach buys "results." Instead of buying predetermined levels of spares, repairs, tools, manpower, and data, the new focus is on buying results—such as a level of availability—to meet the warfighters' objectives. Effective PBL strategies successfully attack reliability, obsolescence, and maintainability issues not by specifying how each is to be provided, but by defining performance at the system level and allowing the PBL support provider determine the specifics. In PBL arrangements, the focus is on customer relationships and meeting warfighter readiness requirements.

The focus of PBL is to buy overarching performance outcomes, and to allow the support provider to make decisions on how to specifically achieve them. PBL efforts will seek to reduce component demands through improved reliability and maintainability [21]. PBL arrangements specify what we want done, not how to do it. This assigns responsibility for performance to the support provider and gives the provider authority and discretion on how to best meet the performance requirements.

Risk

In traditional support arrangements, the Government owns all of the risk for non-performance. The Government defines the effort and retains the risk that what it procures will be sufficient to sustain system readiness. The Government is at risk if the system in the field fails more frequently than expected, if repair parts are not available, or if parts become unsupportable due to obsolescence. In traditional support arrangements, this risk is often addressed by buying large inventories and placing many items close to the soldiers needing them. At the Army level this leads to large, widely distributed inventories that are costly to procure and burdensome to move or redistribute. Contractors are usually involved in support of the systems via time and material contracts. The contractor is paid for performing the service regardless of any potential negative impact on the warfighter.

In PBL arrangements, the risk is shared between the Government and the contractor. The degree of risk sharing is dependent on the scope of the PBL arrangement. In a relatively simple PBL arrangement, the contractor may be responsible for the wholesale distribution of parts and supplies. In this type of arrangement, the contractor assumes the risks of a segment of the supply chain and is responsible for meeting the defined and agreed to supply chain performance metrics. In PBL arrangements, the PSP will attempt to minimize uncertainty throughout the supply chain and will control each of these steps. The result will enable smaller inventories and reduced support costs. In a more complex PBL arrangement, the contractor may be responsible for total system performance. In this highly complex arrangement, the contractor assumes responsibility for the entire system to include complete supply chain performance, component reliability, obsolescence, and maintainability (refer to Figure 3 on page 7.)

The handbook titled "Performance Based Logistics: A Program Manager's Product Support Guide," further defines the risk differences between traditional support arrangements and PBL:

> In traditional support strategies, where DoD purchases transactional goods and services, it is incumbent upon DoD to specify which goods and services are desired, and how many of each are desired. The support provider's only responsibility is to provide the goods or services requested. If DoD managers make inaccurate decisions about which items need to be repaired or what quantity of items need to be purchased, then responsibility for the subsequent degradation of system operational effectiveness lies with DoD, not the support provider. Conversely, when DoD buys a level of support or performance, then the responsibility for the subordinate decisions (i.e., which items to

repair, what quantity of items to procure) transitions to the support provider, along with the risk for operational effectiveness. [22]

Incentives

Traditional support providers must only deliver specific items per the contract and have no incentive to improve the overall weapon system. The traditional focus on supply availability serves as a disincentive for providers to improve system reliability because a higher reliability system will reduce the number of spare parts that the provider will ultimately sell. The supplier's incentive in a traditional arrangement is to sell spare parts, keep repair facilities busy, sell technical support, and to advocate improvements to systems by selling future upgrades. In addition, traditional arrangements provide no incentives to make the supply chain more efficient. In traditional support arrangements, contractors are unlikely to invest anything beyond what is directly paid for by the Government and the contractor often gets paid for correcting deficiencies that they may have created. In traditional support arrangements, there are no incentives for the contractors to introduce improvements to the system. In traditional support arrangements, the Government often buys repairs and spare parts from the same contractor who made the original parts that failed. It can be argued that the traditional support arrangements actually reward the contractors for poorly performing systems.

With more responsibility and flexibility, the support providers frequently invest in improvements in reliability, maintainability, and supportability in order to minimize their costs of delivering the system performance. PBL arrangements inherently motivate support providers to make these system improvements, since these improvements lead directly to reduced support costs—costs that will reduce the support provider's profit in a PBL arrangement. PBL providers also have tremendous incentive to intensively manage the supply chain, since an efficient supply chain will greatly reduce the number of items that are required in the pipeline. PBL strategies will capitalize on strategic alliances and partnerships and will leverage best commercial practices. The result for the Government is often higher reliability, more efficient supply chains, higher quality service, and lower total ownership costs.

PBL arrangements provide incentive by paying the provider for meeting warfighter readiness objectives and not for selling more parts. In effect, a good PBL effort will result in paying the support provider "more" for delivering "less," but less only in the traditional sense of less parts, less repairs, less man-hours, etc.

PBL In Action

This section provides an overview of several PBL arrangements. The examples discussed in this section are not all-inclusive, but are representative of PBL arrangements where commercial companies are a significant service provider. These PBL arrangements to varying degrees transfer risk of performance from the DoD to the contractor providing the PBL support. All of these PBL arrangements are built on two general concepts: 1) improving weapon system operational availability and reliability by updating components with new technologies; and 2) shifting more responsibility from the DoD to the contractor providing support—the PSI and/or PSP.

US Air Force—C-17 Globemaster [23]

Figure 4: US Air Force C-17 Globemaster.

Boeing is the PSI for the C-17 PBL arrangement, carrying what the Air Force calls "Total System Support Responsibility" (TSSR). Boeing's TSSR role encompasses item management and depot level repair of the C-17 airframe and subcomponents. The TSSR arrangement is full-spectrum and includes program management, depot maintenance, equipment repair, supply management, and sustainment engineering functions.

The C-17 PBL arrangement includes six performance metrics:

1. Globemaster Sustainment Aircraft Availability (GSAA) is a measure of the overall health and availability of the fleet.
2. Depot Scheduling is a measure of the effectiveness and efficiency of the C-17 depot maintenance program.
3. Flying Hours Achievable is another metric focused on availability of the fleet and its contribution to wartime preparedness.
4. Parts Issue Effectiveness (repairables and consumables) is a supply chain metric to measure how quickly the supply system delivers parts and consumables once a need is identified.

5. Mission Capable (MICAP) Parts Management is a specific measure of critical parts availability.
6. Customer Satisfaction is a subjective measure that gives the customer a real-time feedback mechanism an input opportunity to contractor rewards.

To achieve these performance metrics, the prime contractor is present at all operational locations. Contractor personnel are very involved in day-to-day sustainment operations and are always aware of emerging trends that may adversely affect their ability to meet performance metrics. As the PBL program matured and the Air Force expanded TSSR responsibilities, the contractor responded with more field support teams and more on-site program management.

US Army—TOW Improved Target Acquisition System (ITAS) [24]

The Army awarded in December 2001 a five-year PBL contract to the original equipment manufacturer (OEM). The contract was fixed-price, fixed-fee, with performance adjustments for increases in Operational Readiness rate above a certain level. The PBL arrangement has supported multiple deployments in Iraq and Afghanistan.

Figure 5: US Army TOW ITAS.

Under the PBL arrangement, the OEM provides inventory management, depot repair, spares production, and total asset management support via a web-based information system. The OEM also provides Field Support Representatives (FSRs) that are embedded with the support battalions to provide forward presence and technical support. During mobilization, the contractor's Forward Repair Activity (FRA) is collocated with the support battalions to provide limited depot level repair. Although the contractors are not required to be on the battlefield, they are on the unit's load plan and ready to deploy.

US Army Shadow Tactical Unmanned Aerial Vehicle (TUAV) [25]

The TUAV project office began PBL implementation in 2003 with a cost-plus fixed fee contract. Early efforts focused on evaluation of the true cost of PBL and on determining the right incentives that would support a transition to a fixed-price contract. This phase provided necessary validation of metrics and of the data collection processes. The current PBL

arrangement is on a cost-plus incentives contract where the contractor and Government share in the benefits of improved performance. The goal is to transition more performance risk to the contractor as the PBL effort matures by awarding a fixed-price contract. The fixed-price PBL arrangement is scheduled to be implemented in 2007 and will result in higher system operational availability, improved mean-time-before-system-abort, reduced logistics footprint, and higher overall system readiness levels.

Figure 6: US Army Shadow TUAV.

The objective performance metrics for the TUAV PBL are System Status Readiness (SSR), Customer Wait Time (CWT), Depot Maintenance Ratio (DMR), and Reliability Growth Rate (RGR). Each of these performance metrics, either alone or in combination with each other, supports operational requirements for system availability and maintainability. SSR is a measure of sub-system readiness and contributes to system operational availability. CWT is a measure of supply chain efficiency and contributes to the time a system is down awaiting parts. DMR is a measure of the parts requiring depot level repair and RGR is a metric that requires improved reliability as the system matures. Improving DMR and RGR results in a system that requires less maintenance.

In addition to the operational readiness and availability metrics, the TUAV PBL arrangement buys contractor managed supply support, contractor managed maintenance support, FSRs, sustainment engineering, training support, and support for deployments.

Contractor involvement and presence with tactical Army units is a key element to the success of this PBL arrangement. FSRs augment tactical Army organizations by providing maintenance support and technical expertise directly to the unit. Project office officials see on-site FSRs remaining a fundamental part of this PBL arrangement for the foreseeable future.

US Army High Mobility Artillery System (HIMARS) Launcher [26]

The HIMARS project office has implemented a PBL agreement with the OEM in which the contractor provides inventory management, repair, overhaul, status monitoring and database management. The Government retains overall program management, contract management,

Figure 7: US Army HIMARS Launcher.

sustainment engineering, readiness monitoring and program oversight. The performance metrics are System Status Readiness (SSR), Mission Capable (MICAP) parts requisition time, and repair turnaround time. SSR metric is a measure of the system availability driven by failures of over 1600 contractor managed items. MICAP is a measure of supply chain response for mission critical components. Repair turnaround time is a measure of the effectiveness and efficiency of the depot repair process.

FSRs are located with tactical units and are critical to the success of this PBL. They provide on-site technical assistance and maintenance support and have access to specialized test equipment. FSRs provide a limited depot repair capability for some component failures. They provide "early warning" to the OEM on emerging maintenance trends and on requisitions that will soon hit the supply system. Project office officials see great value in FSRs and project long-term FSR presence with tactical units.

US Air Force—F-117 Nighthawk

This PBL contract, termed by the Air Force as Total System Performance Responsibility (TSPR), codifies an acquisition strategy that has a single contractor manage all elements of a system to ensure that the entire system meets performance requirements. How the contractor meets the broad performance requirement is at their general discretion. The 1998 contract with Lockheed Martin Corporation included depot maintenance, engineering technical assistance, logistics support, spare parts administration, and subcontractor management. The contract required the contractor to maintain a mission capable rate on the aircraft, and also provided for

Figure 8: US Air Force F-117 Nighthawk.

performance improvements to the F-117 fleet. The contractor exceeded all of the required performance measures during a period when much of the fleet was deployed overseas [27].

To achieve these metrics, the contractor controlled the entire supply chain and provided on-site personnel to assist maintenance processes in the Air Force repair facilities. Lockheed Martin viewed their presence with the Air Force unit is as an essential element of this program's success. Explained by the company's on-site TSPR manager, Rex Romhild, "My team and I are here to communicate not only with the 49th FW but also with the company so everyone knows what the Wing needs as soon as the Wing needs it. The Wing has always allowed us to enter the maintenance complex and talk to the Air Force maintainers. This freedom has given us the ability to anticipate problems and develop solutions before any problem becomes a big deal" [28]. The Air Force also praised the TSPR arrangement. "In all my years in the Air Force, I have never seen a better partnership," says Col. Dick Alquist, 49th FW Logistics Group Commander. "With TSPR, Lockheed Martin has to respond within twenty-four hours to our requests for maintenance and support. They've been averaging less than eight hours. Probably 99.5 percent of the time, they will tell us how to perform the task right here at Holloman. This is truly a team. It is absolutely the most incredible thing I've ever seen in my career" [29].

Analysis

While implementation still faces some significant obstacles, PBL arrangements have shown a number of early successes and continue to mature. PBL is now recognized as a valuable strategy to reduce total ownership costs, improve fleet readiness, and sharpen the supply chain. But will PBL lead to a reduced footprint of contractors on the battlefield?

Trends

A common trend in PBL strategies implemented thus far has been for the Government to select the OEM as a key support provider. This is especially true in newer, recently fielded systems. Interviewed PMs identify several key advantages of selecting the OEM. Among the advantages identified include:

- OEMs are often the only source of technical expertise on the newly fielded system.
- Users have not had the training and experience necessary to effectively troubleshoot and maintain the system.

- OEMs often have the only established supply chain consisting of subcontractors and other suppliers.
- OEMs typically have a proven ability to troubleshoot and maintain the system.
- OEMs are often the only source of proprietary technical data necessary to effectively support the system.

OEMs continue to place FSRs with tactical units. From the OEM perspective, FSRs collect real-time field data and often prevent the unnecessary return of components. From the user perspective, FSRs provide valuable on-site technical expertise that reduces maintenance time and saves unit money spent on repairs and parts.

Commercial companies recognize that reducing costs of doing business include comprehensive inventory management efforts and an intense focus on managing effectively the supply chain. An efficient supply chain dramatically reduces the inventory requirements and dramatically improves the customer satisfaction metric. PBL support providers often arrange their own transportation assets to move parts and supplies from their factory to the DoD "foxhole." These transportation assets can be either company owned assets or contracted assets (e.g., FedEx, UPS, DHL, etc.). The PBL providers essentially operate their own supply chain in parallel to the larger DoD supply chain.

Impacts

For contractors to achieve PBL metrics, they seek to control as many of the variables as possible. Variables include things like component failures, supply availability throughout the supply chain, transportation, and maintenance. When accountable for performance, PBL providers want to be responsible at each level of accountability. If a provider cannot control what they are accountable for, they will be unwilling to enter into a contract where they are responsible. Without accountability and responsibility, the contractors will have an "out" on meeting performance requirements of the contract. As stated in a DoD PBL handbook, "A support provider in a PBL arrangement cannot be held accountable for functions he or she does not directly perform or manage" [30]. "In structuring the metrics and evaluating performance, it is important to clearly delineate any factors that could affect performance but are outside the control of the PBL provider(s)" [31].

Uncertainty is present in all elements of the supply chain—parts availability, distribution processes, reverse logistics, depot repair cycles, etc. Uncertainty is present in demand—driven by false removals, maintenance actions, repair processes, repair time. Uncertainty can grow over time, especially in especially in maintenance actions required as parts get older and fail more often.

When the contractor is responsible for an increasing amount of the support of a system and therefore responsible for an increasing amount of the performance risk, he will seek to control as many aspects of the supply chain as possible. The contractor will strive to eliminate uncertainty and to know all of the "unknowns." Contractors will seek to manage uncertainty and minimize risk to maximize profits. He will minimize risk by maximizing control. To maximize control, it is imperative for the provider to accurately predict the performance of the system in the field. He must continually compare this prediction with actual performance of the system and make adjustments to his PBL service to ensure he consistently meets performance metrics. Being able to predict system performance and adjust service to meet performance metrics is fundamental to the PBL provider's success. Field data is the tool that providers rely on to make predictions and adjustments. Field data is essential to success and every effort made to collect accurate and timely field data is time well spent toward mitigating risk. The source of this field data is often the contractor's FSRs.

An important element of the military supply chain is the "reverse logistics pipeline." The reverse pipeline includes the transportation and repair of parts that are not simply discarded when they fail. A Rand study looking at Army reverse logistics pipeline identified significant potential for improvement [32]—a fact that contractors providing logistics support have noticed. The study stated that two billion dollars worth of repairable parts were returned in 2000 and part of the reverse logistics pipeline [33]. PBL providers desire to control the reverse logistics pipeline to maximize opportunity to meet performance metrics and maximize profits simultaneously. Control of the reverse pipeline enables the contractor to salvage value from broken parts and expedite parts to repair locations. Better control of repairable items in the reverse logistics chain means fewer inventories, better asset visibility, and greater ability to forecast changes—all factors leading to less contractor investment and larger profits.

FSRs enable PBL providers to see and control many of the uncertainties and risks of performance. FSRs help to minimize risks of the unknowns. They know what is going on day to

day in the unit, and are involved in day to day maintenance and troubleshooting. They help reduce the number of costly false removals—serviceable components that are removed due to a suspected failure. False removals can drive costs and unnecessarily exercise the supply chain. FSRs also expedite supply chain at all levels. They are involved in reverse logistics movement of unserviceable components. FSRs are truly focused on the success of their system and on meeting performance metrics in the PBL arrangement.

PBL and Contractors on the Battlefield

Near Term

Many of today's PBL arrangements are successful due in large part to the contributions of industry FSRs. They provide on-site technical assistance and maintenance support to the tactical unit. To cite a recent example, a Stryker Brigade Combat Team (SBCT) deployed to Iraq with over 200 support contractors accompanying the force [34]. Warfighters recognize the value of FSRs and are often unwilling (or unable) to operate without them. From the industry perspective, FSRs provide first-hand information about their system to the PBL provider. In this capacity, FSRs eliminate unknowns and minimize risks for the PBL provider. For these reasons, FSRs will remain with fielded systems in the near term precisely because they are effective and fundamental to the success of PBL.

Long Term

In a perfect PBL implementation, the Army should be able to plan, acquire, train soldiers and field new systems into the force with the contractor performing a purely sustainment function. In the near-term, this is not realistic. But in the long-term, systems designed for reliability and maintainability will make this an achievable goal. Highly reliable components and incorporation of effective diagnostics and prognostics will reduce the need for on-site FSRs. Systems developed with PBL as an up-front design consideration will not break often, and when they do break they will be easy to troubleshoot and repair. These attributes will enable soldiers to operate without FSR support.

However, the long term transition to fewer FSRs will not occur overnight. As the DoD fields reliable, maintainable systems with diagnostics and prognostics, FSRs will likely still be part of the initial PBL package. Industry must gain confidence through field experience that the

system is performing to design requirements and the warfighter must gain confidence that they can indeed maintain and operate this new system on their own.

Conclusions

PBL arrangements work; they are effective in meeting performance metrics and delivering support to the warfighter. But as effective as today's PBL arrangements are, PBL may be more effective later. In most of today's PBL arrangements, PBL was implemented after the system was fielded or late during the system's development phase. Tomorrow's PBL arrangements should be more effective as new systems are fielded since the PBL construct was in place during the systems' development and design phase. Thinking PBL during development focuses the design team and places an increased importance and relevance to logistician involvement in the design process.

Warfighter confidence is essential to PBL success. Warfighters expect the right material, at the right place, at the right time, at the right cost—ALL of the time. If a PBL arrangement is to succeed, it needs buy-in, partnership, and full commitment from the warfighter. PMs must implement metrics that are important and relevant to the warfighter to establish and maintain this commitment.

DoD is in the middle of a logistics process transformation and PMs are simultaneously working to implement PBL arrangements on systems and subsystems. In many of today's PBL arrangements, industry is the single integrator fully in control of its supply chain, employing commercial best practices, acquisition reform, and depot partnerships. However, PBL efforts to date have not been targeted at the large DoD supply chain, but have instead focused on specific platforms, subsystems, or components. The result has generally been optimized PBL support for the specific items while the DoD supply chain remains optimized for the overall process. The DoD supply chain must improve and adjust to accommodate an increasing number of PBL arrangements.

Recommendations

Continue to Refine PBL Implementation

For all of the benefits that FSRs provide, they have become sort of an "addiction" for both the warfighter and the PBL provider. The FSRs provide a near-term "fix" but are not good for the "addicts" in the long term. It is time to focus on recovery. Today's PBL arrangements

must focus more on metrics to reduce logistics footprint and include deliberate incentives for the contractor to move away from FSR dependence. Services should be willing to pay the same (or even more) for the entire PBL effort if it can be done with less face-to-face FSR support. Maintaining system performance and meeting PBL performance metrics with fewer FSRs is highly desirable and the DoD should be willing to reward PBL providers that are able to deliver.

Integrate PBLs with Transforming DoD Logistics Processes

DoD should continue to implement industry best practices for supply chain management, but should also focus on integrating PBL arrangements into the overall supply chain architecture. Many current PBL arrangements essentially operate separate, independent supply chains for all or most of the distance from the factory to the foxhole. Given DoD's focus on improving its logistics processes, there is an opportunity now to combine the PBL and logistics transformation efforts and thereby gain synergistic benefits of both.

DoD logistics transformation activities are focusing on domain-wide asset visibility, rapid and precise logistics response, and unity of effort [35]. These activities are very much like the performance objectives in a typical PBL arrangement. Logisticians desire the ability to see 100% of the requirements, resources, and capabilities available. They desire 24 hours per day/7 days per week connectivity. They desire a fully integrated supply chain with end-to-end visibility with the flexibility to establish and change priorities as the mission requires. Logisticians desire the ability to respond rapidly and precisely with support. Like a typical tactical mission, unity of effort is fundamental to the success a transformed logistics process. Support activities must be coordinated and integrated from the strategic industrial base to the tactical operation—from factory to foxhole—from provider to customer.

The challenge is to integrate the numerous system-specific PBL arrangements with the transforming DoD supply and distribution processes. Integration offers the possibility of sharing common parts and processes, achieving synergy and leveraging the power and weight of entire DoD supply chain. Integration offers a real opportunity for reducing contractors on the battlefield while maintaining effective performance at the tactical user's level.

PBL is on the right track, but implementations must be improved and integrated with other logistics transformation efforts. Improved PBLs should focus on reducing DoD's growing dependence on FSRs. Although FSRs are performing magnificently in the field, their growing

presence is unhealthy for our formations in the long-term. DoD is in the middle of a logistics transformation where the focus is to improve distribution from factory to foxhole. DoD envisions an end-to-end distribution process from source of supply to end-user. But needing improvement is the definition of where and how PBL implementations will interface with the DoD supply chain.

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